

## Claims

[1] A method for detecting a fault of an oil temperature sensor for a hydraulic controller of an automatic transmission by using a determining means for detecting a fault of the oil temperature sensor based on temperature changes of the oil according to a driving mode, the method comprising the steps of:

S1) detecting a vehicle voltage inputted to the oil temperature sensor and comparing the detected vehicle voltage with a critical vehicle voltage 10V;

S2) detecting an input voltage of the oil temperature sensor and comparing the detected input voltage of the oil temperature sensor with a lowest critical temperature 0.1V, the Step S2 comprising the sub-steps of:

S21) repeating an initial state when the vehicle voltage inputted to the oil temperature sensor is less than the critical vehicle voltage (10V);

S22) determining that the oil temperature sensor is normal when the detected vehicle voltage is greater than the critical vehicle voltage (10V); and

S23) comparing an input voltage inputted to the oil temperature sensor with a lowest critical voltage (0.1V) for determining whether there is a fault of the oil temperature sensor;

S3) comparing the input voltage of the oil temperature sensor with a highest critical voltage (4.85V); the Step S3 comprising the sub-steps of:

S31) determining that there is a fault in the oil temperature sensor due to a ground short when the input voltage of the oil temperature sensor is less than the lowest critical voltage (0.1V), and terminating all procedures; and

S32) comparing the input voltage of the oil temperature sensor with a highest critical voltage (4.85V) for detecting the fault of the oil temperature sensor when the input voltage of the oil temperature sensor is greater than the lowest critical voltage (0.1V);

S4) comparing temperature of coolant of an engine, RPM of the engine, and RPM of an output shaft of the automatic transmission with respective corresponding critical values; the step S4) comprising the sub-steps of:

S41) determining that the oil temperature sensor is normal when the input voltage of the oil temperature sensor is less than the highest critical voltage for detecting the fault of the oil temperature sensor, and terminating all procedures; and

S42) comparing temperature of coolant of an engine, RPM of the engine, and

RPM of an output shaft of the automatic transmission with respective corresponding critical values for detecting the fault when the input voltage of the oil temperature sensor is greater than the highest critical voltage for detecting the fault of the oil temperature sensor; and

S43) comparing the RPM of the engine with a critical engine RPM (1000rpm) for detecting a fault of a RPM speed of the engine, and the RPM of an output shaft of the automatic transmission with a critical RPM (500 rpm) of the RPM of the output shaft of the automatic transmission;

S6) comparing a timer with a critical time for detecting a fault; the step S6 comprising the sub-steps of:

S61) stopping and initiating the timer when all detected values do not exceed the critical values, and repeating the step S2);

S62) increasing the timer when all detected values exceed the critical values; and

S63) comparing the timer with the lowest critical voltage (0.1V) for detecting the fault of the oil temperature sensor; and

S7) determining that there is a fault in the oil temperature sensor due to a short of the oil temperature sensor or a shut-off of electric power, the step S7) comprising the sub-steps of:

S71) repeating the step S2) when the timer is less than the critical time for detecting the fault of the oil temperature sensor;

S72) determining that there is a fault due to the short in the oil temperature sensor or a shut-off of the electric power when the timer is greater than the critical time for detecting the fault of the oil temperature sensor; and

S73) terminating all procedures.

[2] A method for detecting a fault of an oil temperature sensor for a hydraulic controller of an automatic transmission by using a determining means for detecting the fault of the oil temperature sensor based on instant temperature change per unit time of the automatic transmission, the method comprising the steps of:

S10) displaying (bit 0=1) enabling/disabling modes of a jumper fault detecting function among fault detecting functions for the oil temperature sensor;

S20) confirming whether the engine is started or not; the step S20 comprising the sub-steps of:

A21) terminating all procedures when the disabling mode (bit 0=0) of the jumper fault detecting function is selected; and

A22) confirming whether the engine has been started or not when the enabling mode (bit 0=1) of the jumper fault detecting function is selected;

S30) comparing the vehicle voltage with the critical vehicle voltage (10V); the step S30 comprising the sub-steps of:

A31) repeating the step of confirming whether the engine has been started or not when the engine has not been started; and

A32) comparing the vehicle voltage with the critical vehicle voltage when the engine has been started;

S40) receiving present oil temperature as an initial oil temperature for detecting the fault of the oil temperature sensor; the step S40 comprising the sub-steps of:

A41) repeating the step of comparing the vehicle voltage with the critical vehicle voltage when the vehicle voltage is less than the critical vehicle voltage; and

A42) receiving the present oil temperature as the initial oil temperature for detecting the fault in order to compare oil temperature changes per unit time when the vehicle voltage is greater than the critical vehicle voltage;

S50) comparing a jump monitoring timer with a jumper fault determining time;

S60) comparing a value of subtracting initial oil temperature for detecting a jumper fault from a maximal measured oil temperature for determining the jumper fault with a critical oil temperature rate of change for determining the jumper fault;

A61) reading the maximal measured oil temperature of the jumper fault for determining the fault of the oil temperature sensor when the jump monitoring timer is less than the jumper fault determining time;

A62) receiving the oil temperature of the automatic transmission;

A63) repeating the step of comparing jump monitoring timer with the jumper fault determining time; and

A64) comparing the value of subtracting the initial oil temperature from the maximal measured oil temperature with the critical oil temperature rate of change for determining the jumper fault when the jump monitoring timer is greater than the jumper fault determining time;

S70) increasing a jumper fault confirming timer; the step of S70 comprising the sub-steps of:

A71) repeating the step of comparing the vehicle voltage with the critical vehicle voltage (10V) when the difference between the maximal measured oil temperature and the initial oil temperature is less than the critical oil temperature

rate of change; and

A72) increasing the jumper fault confirming timer when the difference between the maximal measured oil temperature and the initial oil temperature is greater than the critical oil temperature rate of change;

S80) comparing the difference between the maximal measured oil temperature for determining the jumper fault and the initial oil temperature for detecting the jumper fault with the critical oil temperature rate of change (10 degrees centigrade) for determining the jumper fault; and

S90) comparing the jumper fault confirming timer with a jumper fault confirming time; the step S80 comprising the sub-steps of:

A91) comparing the vehicle voltage with the critical vehicle voltage (10V) when the difference between the maximal measured oil temperature and the initial oil temperature is less than the critical oil temperature rate of change for determining the jumper fault;

A92) comparing the jumper fault confirming timer with the jumper fault confirming time when the difference between the maximal measured oil temperature and the initial oil temperature is greater than the critical oil temperature rate of change for determining the jumper fault; and

A93) repeating the step of increasing the jumper fault confirming timer when the jumper fault confirming timer is less than a fault confirming time (3 sec) for determining fault of the oil temperature sensor by detecting the temperature rate of change; and

S100) determining that there is fault of the oil temperature sensor when the jumper fault confirming timer is greater than a fault confirming time (3 sec) for determining fault of the oil temperature.

[3] A method for detecting a fault of an oil temperature sensor for a hydraulic controller of an automatic transmission by using a determining means for detecting the fault of the oil temperature sensor in the stuck state of a detected signal of the oil temperature sensor in a driving mode where transmission oil temperature increases, the method comprising the steps of:

S101) confirming whether enabling (bit 1=1)/disabling (bit 1=0) modes of a stuck fault detecting function among fault detecting functions of the oil temperature sensor are displayed;

S102) comparing a vehicle voltage with a critical vehicle voltage (10V); the step S102 comprising the sub-steps of:

B21) terminating all procedures when the disabling mode (bit 1=0) of the stuck fault detecting function is selected; and

B22) comparing the vehicle voltage with the critical vehicle voltage (10V) when the enabling mode (bit 1=1) of the stuck fault detecting function is selected;

S103) comparing the transmission oil temperature with a maximal transmission oil temperature (50 degrees centigrade) for determining the fault of the oil temperature sensor in the stuck state; the step S103) comprising the sub-steps of:

B31) terminating all procedures when the vehicle voltage is less than the critical vehicle voltage; and

B32) comparing the transmission oil temperature with the maximal transmission oil temperature (50 degrees centigrade) for determining the fault of the oil temperature sensor in the stuck state when the vehicle voltage is greater than the critical vehicle voltage;

S104) confirming whether signals of engine RPM and RPM of an output shaft of the automatic transmission are normal or not; the step S104) comprising the sub-steps of:

B41) terminating all procedures when the transmission oil temperature is greater than the maximal transmission oil temperature (50 degrees centigrade); and

B42) confirming whether the signals of engine RPM and RPM of an output shaft of the automatic transmission are normal or not when the transmission oil temperature is less than the maximal transmission oil temperature (50 degrees centigrade);

S105) determining whether a clutch is under control or not; the step S105) comprising the sub-steps of:

B51) initiating the critical time measuring timer and repeating the step S103) when the signals of engine RPM and RPM of an output shaft of the automatic transmission are abnormal, the critical time measuring timer is initiated; and

B52) comparing RPM of the output shaft of the automatic transmission with critical RPM (500 rpm) of an output shaft of the automatic transmission for determining the fault of the oil temperature sensor in the stuck state when the signals of engine RPM and RPM of an output shaft of the automatic transmission are normal;

S106) increasing a critical time measuring timer for detecting the fault of the oil temperature sensor at the stuck state; the step S106) comprising the sub-steps of:

B61) maintaining the critical time measuring timer and repeating the Step S103)

when both RPM of the output shaft and engine RPM do not exceed the critical RPM and the critical engine RPM; and

B62) increasing the critical time measuring timer when both RPM of the output shaft and engine RPM exceed the critical RPM and the critical engine RPM; S107) comparing a value of subtracting initial oil temperature for detecting the stuck fault from the transmission oil temperature with a critical oil temperature rate of change (5 degrees centigrade) for determining the fault of the oil temperature sensor in the stuck state,

S108) initiating the critical time measuring timer and setting the oil temperature of the transmission oil as an initial oil temperature for detecting the stuck fault; the step S108) comprising the sub-steps of:

B81) initiating the critical time measuring timer when the value of subtracting initial oil temperature from the transmission oil temperature is greater than the critical oil temperature rate of change (5 degrees centigrade);

B82) setting the oil temperature of the transmission oil to an initial oil temperature for detecting the stuck fault; and

B83) repeating the step S103); and

S109) comparing the critical time measuring timer with the critical time for determining the fault of the oil temperature sensor in the stuck state; the step S109) comprising the sub-steps of:

B91) comparing the critical time measuring timer with the critical time for determining the fault of the oil temperature sensor in the stuck state when the value of subtracting initial oil temperature from the transmission oil temperature is less than the critical oil temperature rate of change (5 degrees centigrade);

B92) repeating the step S103) when the critical time measuring timer is less than the critical time; and

B93) determining that there is the fault of the oil temperature sensor in the stuck state when the critical time measuring timer is greater than the critical time.

[4]

A method for detecting a fault of an oil temperature sensor for a hydraulic controller of an automatic transmission by detecting oil temperature of the automatic transmission based on how long the engine has been turned off by using a determining means for detecting the fault of the oil temperature sensor, the method comprising the steps of:

S201) confirming whether enabling (bit 2=1)/disabling (bit 2=0) modes of oil temperature sensor fault detecting function in the state that the engine is turned

off at room temperature for a long time, among fault detecting functions of the oil temperature sensor, are displayed or not;

S202) confirming whether the engine has been started or not; the step S202) comprising the sub-steps of:

C21) terminating all procedures if the disabling mode (bit 2=0) is selected, are terminated; and

C22) confirming whether the engine has been started or not if the enabling mode (bit 2=1) is selected;

S203) comparing a vehicle voltage with a critical vehicle voltage (10V); the step S202) comprising the sub-steps of:

C31) repeating the step S202) if the engine has not been started; and

C32) comparing the vehicle voltage with the critical vehicle voltage (10V) if the engine has been started;

S204) receiving the time indicating how long the engine has been stopped at room temperature; the step S204) comprising the sub-steps of:

C41) comparing the vehicle voltage with the critical vehicle voltage (10V) again if the vehicle voltage is less than the critical vehicle voltage (10V); and

C42) receiving the time indicating how long the engine has been stopped at room temperature;

S205) comparing the time indicating how long the engine has been stopped at room temperature with a critical engine-stopped time for determining a fault of the oil temperature sensor in the engine-stopped state;

S206) confirming whether a temperature signal of engine coolant and a temperature signal of intake-air are normal or not; the step S206) comprising the sub-steps of:

C61) terminating all procedures if the engine-stopped time is less than the critical engine-stopped time; and

C62) confirming whether the temperature signal of engine coolant and the temperature signal of intake-air are normal or not when the engine-stopped time is greater than the critical engine-stopped time ;

S207) comparing the difference between the temperature of the engine coolant and the temperature of the intake-air with a temperature difference for determining the engine-stopped fault; the step S207) comprising the sub-steps of:

C71) terminating all procedures if the temperature signal of engine coolant and the temperature signal of intake-air are abnormal;

C72) comparing the difference between the temperature of the engine coolant and the temperature of the intake-air with the temperature difference for determining the engine-stopped fault if the temperature signal of engine coolant and the temperature signal of intake-air are normal;

S208) comparing the difference between the oil temperature and the coolant temperature with a temperature difference for determining the engine-stopped fault; the step S208) comprising the sub-steps of:

C81) terminating all procedures if the difference between the temperature of the engine coolant and the temperature of the intake-air are greater than the temperature difference for determining the engine-stopped fault;

C82) comparing the difference between the oil temperature and the coolant temperature with temperature difference for determining the engine-stopped fault when the difference between the temperature of the engine coolant and the temperature of the intake-air is less than the temperature difference for determining the engine-stopped fault; and

S209) determining a high temperature stuck fault; the step S209) comprising the sub-steps of:

C91) terminating all procedures when the difference between the oil temperature and the coolant temperature is less than the temperature difference for determining the engine-stopped fault; and

C92) determining that there is a high temperature stuck fault in the oil temperature sensor when the difference between the oil temperature and the coolant temperature are greater than the temperature difference for determining the engine-stopped fault.

[5] The method as set forth in claim 1, further comprising all the steps of the method for detecting the fault of the oil temperature sensor for the hydraulic controller of the automatic transmission by using the determining means for detecting the fault of the oil temperature sensor based on instant temperature change per unit time of the automatic transmission as set forth in claim 2.

[6] The method as set forth in claim 1, further comprising all the steps of the method for detecting the fault of the oil temperature sensor for the hydraulic controller of the automatic transmission by using the determining means for detecting the fault of the oil temperature sensor at the stuck state of the detected signal of the oil temperature sensor in the driving mode where transmission oil temperature increases as set forth in claim 3.

- [7] The method as set forth in claim 1, further comprising all the steps of the method for detecting the fault of the oil temperature sensor for the hydraulic controller of the automatic transmission by detecting the oil temperature of the automatic transmission based on how long the engine has been stopped by using the determining means for detecting the fault of the oil temperature sensor as set forth in claim 4.
- [8] The method as set forth in claim 1, further comprising all the steps of the method for detecting a fault of the oil temperature sensor for the hydraulic controller of an automatic transmission by using the determining means for detecting the fault of the oil temperature sensor at the stuck state of the detected signal of the oil temperature sensor in a driving mode where transmission oil temperature increases as set forth in claim 3.
- [9] The method as set forth in claim 5, further comprising all the steps of the method for detecting the fault of the oil temperature sensor for the hydraulic controller of the automatic transmission by detecting the oil temperature of the automatic transmission based on how long the engine has been stopped by using the determining means for detecting the fault of the oil temperature sensor as set forth in claim 4.
- [10] The method as set forth in claim 8, further comprising all the steps of the method for detecting the fault of the oil temperature sensor for the hydraulic controller of the automatic transmission by detecting the oil temperature of the automatic transmission based on how long the engine has been stopped by using the determining means for detecting the fault of the oil temperature sensor as set forth in claim 4.